



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#8/ 12.5-1.1e  
6/19/03  
W

In re Patent Application of

STRATTON et al.

Atty. Ref.: 34-105

Serial No. 09/744,664

Group: 3752

Filed: September 18, 2000

Examiner: Kim, Christopher

For: A ROTARY DEVICE FOR TRANSMISSION OF MATERIAL IN  
PARTICULATE FORM

\* \* \* \* \*

June 10, 2003

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

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JUN 11 2003

TECHNOLOGY CENTER R3700

Sir:

**REQUEST TO VACATE OFFICIAL ACTION OF MAY 30, 2003 AND REQUEST FOR  
ISSUANCE OF NEW OFFICIAL ACTION**

It is respectfully requested that the Official Action mailed May 30, 2003 be withdrawn/vacated and that a new Official Action on the merits be issued on this application on the basis of the following:

The May 30, 2003 Official Action states that only claims 1-7 are pending in this application and states that claims 4-7 are in improper multiply dependent form. Further, the Office Action states that reference to the International Application is required under 35 USC 120 in the first sentence of the specification. None of these statements/objections are consistent with the as-filed application. From a teleconference with the Examiner, it is apparent that Patent Office personnel erroneously treated this application as a national phase of the PCT priority application and placed the PCT text in the file for examination by the Examiner. However, this application was filed as a continuation of PCT/GB98/01675 and was filed with an application text and claims for examination. Attached is a copy of this application as filed on September 18, 2000 together with a copy of the undersigned's postcard receipt. Copies of the listed prior art are not attached as it is understood that the Examiner's file

BEST AVAILABLE COPY

STRATTON et al.  
Serial No. 09/744,664  
June 9, 2003

contains the September 18, 2000 Information Disclosure Statement and references. A Notice of Missing Parts was ultimately mailed on April 16, 2001 and a Filing Completion was submitted on June 14, 2001. It is understood that the Filing Completion is present in the Examiner's file.

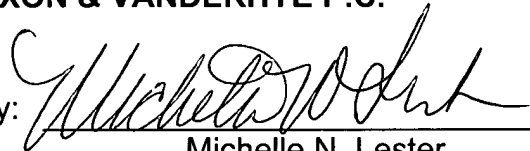
Because, from the Examiner's May 30, 2003 Official Action, it is evident that due to Patent Office error, the Examiner's file was prepared with the PCT text, not the application as filed on September 18, 2000 for examination, it is respectfully submitted that the May 30, 2003 Official Action should be withdrawn and a new Official Action on the application as filed should now be issued.

If there are any questions regarding this Request, please contact the undersigned.

Respectfully submitted,

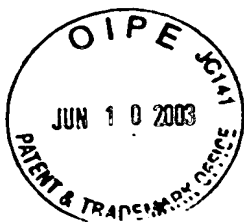
**NIXON & VANDERHYE P.C.**

By:



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JUN 11 2003

TECHNOLOGY CENTER R3700

New Continuation Patent Application of PCT/GB98/01675

Atty: Michelle N. Lester

Serial No.: (To Be Assigned) Date: Sep. 18, 2000

Inventor/s: STRATTON et al. C#/M#: 34-105

Title: ROTARY PAINT SPRAYER

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

	Amendment
16	Pages Specification, Claims & Abstract
15	Claims
1	Sheets of Drawings
X	Information Disclosure Statement
X	PTO-1449
28	References
X	International Search Report
\$0	Fee (Check)

Other: Coversheet





IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
REQUEST FOR FILING APPLICATION UNDER 37 CFR 1.53(b)  
WITHOUT FILING FEE OR EXECUTED INVENTOR'S DECLARATION

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Assistant Commissioner for Patents  
Washington, DC 20231

Atty. Dkt. 34-105

Date: September 18, 2000

JUN 11 2003

TECHNOLOGY CENTER R3700

Sir:

This is a request for filing a new PATENT APPLICATION under Rule 53(b) entitled:  
A ROTARY DEVICE FOR TRANSMISSION OF MATERIAL IN PARTICULATE FORM  
without a filing fee and/or without an executed inventor's oath/declaration.

This application is made by the below identified inventor(s). Attached hereto are the following papers:

- ☒ An abstract together with  
15 pages of specification and claims including  
15 numbered claims and also attached is/are  
1 sheets of accompanying drawings.  
☒ This application is based on the following prior foreign application(s):

Application No.	Country	Filing Date
9806709.3	GREAT BRITAIN	27 March 1998
19721615.3	GERMANY	23 May 1997
PCT/GB98/01675	GREAT BRITAIN	8 June 1998

respectively, the entire content of which is hereby incorporated by reference in this application, and priority is hereby claimed therefrom.

- ☐ This application is based on the following prior provisional application(s):  
Application No. Filing Date

respectively, the entire content of which is hereby incorporated by reference in this application, and priority is hereby claimed therefrom.

- ☐ Certified copy/ies of foreign applications attached.  
☐ This application is a ☐ continuation/☐ division/☐ continuation-in-part of application Serial No. , filed  
☐ Please amend the specification by inserting before the first line: --This application is a ☐ continuation/☐ division/☐ continuation-in-part of application Serial No. , filed , the entire content of which is hereby incorporated by reference in this application.--  
☐ Please amend the specification by inserting before the first line: --This is a continuation of PCT application No. PCT/GB98/01675, filed , the entire content of which is hereby incorporated by reference in this application.--  
☐ Preliminary amendment to claims (attached hereto), to be entered before calculation of the fee.  
☒ Also attached. Information Disclosure Statement/ PTO-1449/ Twenty-eight References

1.	Inventor:	John	D.	STRATTON	British
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NOTE: FOR ADDITIONAL INVENTORS, check box ☐ and attach sheet with same information.

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By Atty: Michelle N. Lester, Reg. No. 32,331

Signature:



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JUN 11 2003  
TECHNOLOGY CENTER R3700

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

STRATTON et al.

Atty. Ref.: 34-105

Serial No. (To Be Assigned)

Group:

National Phase of PCT/GB98/01675

Filed: September 18, 2000

Examiner:

For: A ROTARY DEVICE FOR TRANSMISSION OF MATERIAL IN  
PARTICULATE FORM

September 18, 2000

Assistant Commissioner for Patents  
Washington, DC 20231

INFORMATION DISCLOSURE STATEMENT

Sir:

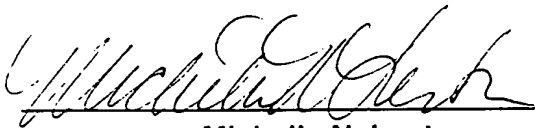
As suggested by 37 C.F.R. 1.97, the undersigned attorney brings to the attention of the Patent and Trademark Office the references listed on the attached form PTO-1449, a copy of each of which is enclosed. This is not to be construed as a representation that a search has been made or that no better prior art exists, or that a reference is relevant merely because cited.

Also, enclosed is a Search Report issued in connection with a parallel PCT application, which indicates relevant passages of certain of the herewith documents.

The Examiner is requested to initial the attached form PTO-1449 and to return a copy of the initialed document to the undersigned as an indication that the attached references have been considered and made of record.

Respectfully submitted,

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Sheet 1 of 1

INFORMATION DISCLOSURE  
CITATION

(Use several sheets if necessary)

ATTY. DOCKET NO.

34-105

APPLICANT

STRATTON et al.

FILING DATE

September 18, 2000

SERIAL NO.

(To Be Assigned)

RECEIVED

GROUP

JUN 11 2003

## U.S. PATENT DOCUMENTS

TECHNOLOGY CENTER R3700

*EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	3,669,514	06/1072	WADA et al.			
	5,634,326	01/1997	WANGER			
	4,710,034	12/1987	TITTIZER et al.			
	3,796,472	03/1974	FERNLUND			
	2,473,035	06/1949	MEADE et al.			

## FOREIGN PATENT DOCUMENTS

		DOCUMENT	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
							YES	NO
		3901804 C1	04/1990	DE			Abstract	
		195 17 477 A1	11/1996	DE			(2) Abstracts	
		2 142 559 A	01/1985	GB				
		685,871	01/1953	GB				
		960,102	06/1964	GB				
		2 271 069 A	04/1994	GB				
		2 197 224 A	05/1988	GB				
		471,865	09/1937	GB				
		663,634	12/1951	GB				
		865,765	??/1961	GB				
		1 515 511	06/1978	GB				
		1 597 349	09/1981	GB				
		2 008 439 A	06/1979	GB				
		0 052 952 A1	06/1982	EP				
		0 109 224	05/1984	EP				
		0 508 771 A1	10/1992	EP				
		0 780 159 A1	06/1997	EP				
		0 246 032	11/1987	EP				
		1.224.667	06/1960	FR				X
		1.472.066	03/1967	FR				X
		1.274.814	11/1959	FR				X

## OTHER DOCUMENTS (including Author, Title, Date, Pertinent pages, etc.)

	Patents Abstracts of Japan M-544 12/1986 vol. 10/No. 372; 61-165015, INAHATA "PNEUMATIC ELEVATING DEVICE"
	Patents Abstracts of Japan 01/1980; 55011064, MASASHI "ROTARY TYPE ELECTROSTATIC COATER FOR CONDUCTIVE PAINT"
*Examiner	Date Considered

Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to application.

Form PTO-FB-A820 (Also PTO-1449)

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 98/01675

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 B05B5/04

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 473 035 A (R. E. MEADE ET AL) ✓ 14 June 1949 see column 7, line 19 - line 52; figures ---	1
X	FR 1 224 667 A (FARBENFABRIKEN BAYER AG) ✓ 24 June 1960 see page 2, left-hand column, line 21 - line 27; figure 4 ---	1
A	FR 1 472 066 A (S.A. DES ÉTABLISSEMENTS NEU) 24 May 1967 ✓ see page 1, right-hand column, line 12 - line 20 see page 1, right-hand column, line 35 - line 45; figures --- -/--	1

☒ Further documents are listed in the continuation of box C

☒ Patent family members are listed in annex.

**Special categories of cited documents:**

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "Z" document member of the same patent family

Date of the actual completion of the international search

4 November 1998

Date of mailing of the international search report

16/11/1998

Name and mailing address of the ISA

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Authorized officer

Brévier, F

# INTERNATIONAL SEARCH REPORT

Intern. Appl. Application No.

PCT/GB 98/01675

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication where appropriate of the relevant passages	Relevant to claim No.
A	FR 1 274 814 A (J. SEDLACSIK) 21 February 1962 see page 4, right-hand column, line 14 - line 35; figures ---	1
A	EP 0 246 032 A (CASE SYSTEMS LTD) 19 November 1987 see column 3, line 36 - line 46; figure 1 ---	1
A	PATENT ABSTRACTS OF JAPAN vol. 004, no. 038 (C-004), 27 March 1980 & JP 55 011064 A (TOYOTA MOTOR CORP), 25 January 1980 see abstract -----	



# INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern. Appl. Application No

PCT/GB 98/01675

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2473035	A	14-06-1949	NONE	
FR 1224667	A	24-06-1960	NONE	
FR 1472066	A	24-05-1967	NONE	
FR 1274814	A	21-02-1962	NONE	
EP 0246032	A	19-11-1987	GB 2190309 A.B	18-11-1987

Our Ref.: 34-105  
NIS/LE/34897

# ***U.S. CONTINUATION PATENT APPLICATION***

***Inventor(s):*** John D. STRATTON  
Robert D. TAYLOR

***Invention:*** A ROTARY DEVICE FOR TRANSMISSION OF MATERIAL IN  
PARTICULATE FORM

***NIXON & VANDERHYE P.C.  
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## ***SPECIFICATION***

"A Rotary Device for Transmission of Material in Particulate Form"

BACKGROUND TO THE INVENTION

This application is a continuation of PCT/GB98/01675, filed 8 June  
5 1998.

The present invention relates to rotary devices for transmitting material in particulate form particularly for deposition on a surface. The material may be a solid, a liquid, a gel, a powder or a suspension when supplied, but is or becomes particulate when airborne.

10 Reference is made at this stage to US Patent 2, 473,035 which discloses a device for producing dried powder by use of contra-rotating conical surfaces, however, that device does not produce a controlled beam which could be used for depositing material on a surface.

Rotary devices are known, for example electrostatically controlled  
15 atomising paint spraying devices, where the material to be deposited is forced through a high speed rotary bell-shaped outlet which atomises and directs the material as a conical beam onto a surface while assisted by a high voltage electrostatic charge between the surface and the particles.

Generally the material to be deposited, such as paint, will be a liquid or  
20 suspension, but other suspended materials, solids and powders can be handled in this way dependent on the application provided they are able to be in particulate

form when airborne.

There are various design problems associated with provision of an efficient rotary deposition device.

It is desirable that an accurate beam of atomised material is achieved with  
5 minimum energy input, and for certain applications it is desirable that the unit should be small, light and controllable, particularly when it is to fit on the end of a robot arm.

To this end a conical or cylindrical curtain of high velocity air can be supplied so as to encircle the emerging conical beam or mist of atomised particles.  
10 This constrains the beam so as to re-shape the beam into a more closely confined and accurate spray.

However a problem arises in that the velocity required for the shaping air curtain needs to relate to the particle velocity required for adequate atomisation. Otherwise there is a risk of damage of the mist shape and coagulation of the mist  
15 particles.

### SUMMARY OF THE INVENTION

According to one aspect of the invention therefore there is provided an electrostatically controlled device for transmitting a beam of material in particulate  
20 form at a target surface to be coated

comprising an outer bell-shaped member which is rotatable about a

principal axis and arranged to project a conical curtain of small particles flowing generally towards a target,

supply means for supply of material from a reservoir source and centrally outwards from said principal axis and towards a peripheral internal shaping region of said outer bell-shaped member to create said conical curtain of small particles,

characterised in that an inner rotary bell-shaped member is provided coaxially with said outer bell-shaped member and is arranged to rotate at a different rate to that of said outer bell-shaped member so that at least a major part of the material emerging from said supply means is subject to differing rotary forces imparted by both the inner and outer rotary bell-shaped members.

Generally for best results an inner surface of the outer bell-shaped member in an operative region where it receives emergent material for atomisation should be roughened. Also it is desirable that the outer bell-shaped member should in its operative region extend outwardly of the inner bell-shaped member.

Use of two bell-shaped members has the immediate advantage that the velocities required for adequate atomisation or mist production can be substantially reduced. This means that if an external air curtain is to be used, the differences in velocity of the mist particles and of the air curtain can be reduced, and so better results can be achieved.

Generally the two bell-shaped members will rotate in opposing directions, but that is not always to be preferred. In some cases rotation in the same

direction but at significantly different rates will be effective

Other benefits of reduced velocity are that less energy is required, and that  
- even in the absence of an external air curtain - the conical beam will be subject  
to less external scattering since the centrifugal velocity energy of the particles  
5 (dependent on the square of the velocity) will be reduced.

Another advantage is that the difference in speeds of the two bell-shaped  
members can be adjusted if desired in order to optimise performance of the  
device. If this is required, the two bell-shaped members should be independently  
adjustable in speed.

10 Preferably a centrally located diffuser disc is provided externally to said  
supply means and perpendicular to said principal axis and includes a centrally  
located deflector which deflects at least some of the emergent material into contact  
with an internal surface of said inner bell-shaped member and thence to an internal  
surface of the outer bell-shaped member. The rotary diffuser disc may be integral  
15 with the inner bell-shaped member so as to rotate integrally with it. Preferably the  
remainder of said material is arranged to be passed through apertures in said disc  
and onto an external face of said disc and then to be fed centrifugally into the  
region of said peripheral internal shaping region of said outer bell-shaped member.

Generally it is preferred to provide an external cylindrical or conical  
20 curtain of air surrounding said beam of particles. Since air under an elevated  
pressure is required for this purpose, it is convenient to use the same air pressure

source for other functions within the device.

The two rotary bell-shaped members can be rotated by any suitable driven rotor system, but the use of air pressure is particularly convenient. Thus the bell-shaped members can form part of, in each case, an air turbine. Also, air bearings  
5 utilising air under pressure can, if desired, be used to support rotation of the rotary parts of the device. However it is an important preferred feature of the invention that these bearings should be supplied with air separately from the air turbines to avoid undesired interactions, that is separate conduits are provided for the air turbines and for the bearings.

10 The device operates most effectively when there is a high voltage electrostatic charge between the particles and their target. This can, if desired, be achieved by earthing the target and applying a high voltage to the emerging particles or to the material prior to its becoming particulate.

In a convenient form of the invention the voltages required can be  
15 generated internally within the device. If a rotary member carries conductors or magnets and a static part of the device carries the converse, an electric generator arises and the resultant generated voltage can be arranged to charge the particles.

The device is of particular advantage when used in a painting (coating) tool with two turbines incorporating the bell-shaped members and driven by  
20 compressed air, which enclose a central tube carrying the deposition material which is then forced outwardly towards the turbines. Both bell-shaped members

produce a form of centrifugal acceleration of the paint particles which are at least partially atomised as they strike against the inner surfaces of the bell-shaped members. The atomised particles are then propelled in the general direction of the object to be painted (coated). The resulting coating has a characteristically very smooth and even surface profile.

Both turbines are supported preferably on air bearings. The compressed air can be fed to each turbine through an inlet or inlets in the casing and which then exits to atmosphere, and can be supplied separately and in parallel, in each case to a hollow cylinder bearing downstream from the turbine drive in a parallel operation which also exits to atmosphere.

It was found that counter rotation of the two turbines reduces the required speed considerably while improving the quality of the coating. Conventional turbine driven paint tools rotate at a speed ranging from 16,000  $\text{min}^{-1}$  and 70,000  $\text{min}^{-1}$  while counter-rotation enables the speed of each turbine to be reduced to approximately 10,000  $\text{min}^{-1}$ , or in some cases as low as 5,000  $\text{min}^{-1}$ . As a result, the size and weight of the turbines can be reduced. The propelled compressed air is able to have a lower kinetic energy content which ultimately means that the volume of the compressed air generating blower or ventilator can be reduced. All these factors play a decisive role if the output of the paint (coating) application tool has to be directed very precisely over the object to be coated, as is the case for instance, for vehicle bodywork paint spraying systems.



A desirable aim in many cases is to reduce weight and to this end it is preferable that when perforated hollow cylinders are used to provide air bearings, the cylinders are of plastics or ceramic materials. For a quick and economical change of coating medium, e.g. the colour of a car paint, the components carrying the coating medium may be in the form of a ceramic, metal or composite outer casing having suitably selected surface properties.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a longitudinal section view of a coating device to the invention.

10

#### DESCRIPTION OF A PREFERRED EMBODIMENT

An embodiment of the invention will now be described by way of example with reference to the accompanying drawing.

The figure shows a longitudinal section through a coating tool. The surface to be painted is labelled 1, and is located at a distance from the tool which is dependent on the application parameters to be used. The tool essentially comprises a central tube 2, which carries a coating medium which has been supplied from an external supply source, an inner turbine 3 an outer turbine 4, together with supporting bearings (in this case air bearings) 10 and 11 and a fixed casing 5.

20

Both turbines are driven by compressed air which passes from the rear of

the casing via conduits to the turbine blades 8 and 9, through separate supply holes. Similar supply connections and conduits are provided for reverse or braking motion of the turbines 8A and 9A. The impact surfaces of the turbine blades 8 and 9 are so arranged that the turbines 3 and 4 rotate in a counter  
5 direction to one another.

In the case described, the bearings provide both axial and radial support for the turbines by the use of air, supplied from a connection on the housing through numerous controlled conduits or passageways 15 and 13, quite separate from and in parallel with the conduits for the turbines, to accurately controlled  
10 voids between the static and rotating surfaces. The air then exhausts through passage 6. The turbines 3 and 4, thus supported are centred and free to rotate on air bearings while having no physical contact with each other or their bearings, or the casing 5.

Carried at the ends of the turbines 3 and 4 are bell shaped members 23 and  
15 24. These are arranged so as to rotate concentrically, with the end of the inner bell shaped member 23 being inside the outer bell shaped member 24, and the outer bell-shaped member extending beyond the front edge of the inner bell-shaped member. In the case described, the outer bell shaped member has an inner surface, at its end which is of a selected shape and roughness to promote  
20 atomisation, while the inner bell shaped member incorporates a conical diffuser 21 and a transfer disc 23A, which are integral with the inner bell-shaped member

and therefore rotate integrally with it. The roughened surface of the outer bell-shaped member should extend from a region opposite the tip of the inner bell-shaped member to the outermost end, or tip, of the outer bell-shaped member.

At the end of the medium supply tube 2 is a controlled orifice which ejects  
5 the coating medium onto the deflector 21 which is revolving as part of the inner bell shaped member 23, 23A. This diverts a proportion of the medium through a controlled gap between the inner bell shaped member 23 and the diffuser disc 23A while allowing the remainder to pass through a hole or holes in the transfer disc, to the front of the diffuser disc 23A.

10 By virtue of the centrifugal forces exerted on the coating medium by the rotational movement, the medium passes, either side of the diffuser disc, to be thrown from the tip in a generally radial trajectory 26. The spray thus produced, now impinges on the roughened inner surface of the outer bell shaped member 24 which has the effect of "atomising" and shaping the trajectory of the droplets.

15 The cone of mist may then be subjected to the effects of shaping from the air curtain produced by the controlled passage of air through a shaping air ring 27, via supply line 27A.

The application of a high electrostatic potential between the coating medium and the target 1 will enhance the performance. This electrostatic charge  
20 can be applied outside the tool (via electrodes penetrating the mist) or inside via a connection to the paint tube from an externally or internally generated source, and can be applied to the medium prior to, during or after atomisation.

Various other features may be included in the tool, such as speed indication (and control via external equipment). This is achieved by the feedback of optical, electrical, pneumatic or audible signals to a suitable output device from the turbines.

5           Hole 19 on the drawing is an access for a pin to lock the turbine to facilitate removal and replacement of the bell.

          The application of a high voltage between the tool and the surface 1 which produces an electrostatic acceleration of the atomised paint particles, is not shown. This can as previously mentioned be supplied from an external source or it can be  
10   generated by the counter-rotation movements of the outer and inner turbines 4 and  
5   to allow this high voltage to be generated using a generator effect arising from the relative movement of these components.

          The invention is not limited to the exemplary design described above. A number of variants is conceivable which are able to make use of features of the  
15   invention, even where some aspects of detail may be different.

We claim:

1. An electrostatically controlled device for transmitting a beam of material in particulate form at a target surface to be coated, said device

5 comprising an outer bell-shaped member which is rotatable about a principal axis and arranged to project a conical curtain of small particles flowing generally towards said target surface;

a supply system for supplying material from a reservoir source towards a peripheral internal shaping region of said outer bell-shaped member; and

10 an inner rotary bell-shaped member provided coaxially with said outer bell-shaped member and arranged to rotate differently to said outer bell-shaped member so that at least a major part of the material supplied by said supply system is subject to differing rotary forces imparted by the inner and outer rotary bell-shaped members.

15

2. A device as claimed in claim 1, in which each bell-shaped member is integral with an air turbine which is driven by air pressure to rotate said bell-shaped member.

20 3. A device as claimed in claim 2, in which each bell-shaped member is arranged to be supported and rotated on air bearings, and the bearings are supplied

with air via conduits which are separate from conduits supplying air to the air turbines, so that the bearings are supplied with air separately from the air turbines.

4. A device as claimed in claim 1, further comprising a centrally located  
5 rotary diffuser disc for transmission of said material from said supply system to the inner rotary bell-shaped member.

5. A device as claimed in claim 4, which includes a centrally located rotary deflector which is arranged to deflect at least some of said material supplied by  
10 said supply system into contact with an internal surface of said inner bell-shaped member.

6. A device as claimed in claim 5, in which said diffuser disc and said deflector are integral with said inner bell-shaped member so as to rotate therewith.  
15

7. A device as claimed in claim 4, in which said disc has at least one aperture therethrough so that some of said material supplied by said supply system can pass through said apertures and onto an external face of said disc so as to be forced outwards centrifugally towards the outer bell-shaped member.

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8. A device as claimed in claim 1, further comprising an air shaping ring for provision of a shaping curtain of air emanating to encircle and control said conical curtain of small particles.

- 5 9. An electrostatically controlled coating device comprising:
- a first rotary bell-shaped member having an axis of rotation and an internal shaping region arranged to project a conical curtain of particulate material towards a target surface;
  - a supply system for conducting said material towards said first rotary bell-
  - 10 shaped member; and
  - a distributor arrangement for distributing said material from said supply system onto said internal shaping region, said distributor arrangement comprising a second rotary bell-shaped member disposed inwardly of said first rotary bell-shaped member and coaxial therewith and a rotary disc associated with said
  - 15 second rotary bell-shaped member and defining at least one through-hole leading from an inner face of said disc which faces said second rotary bell-shaped member to an outer face of said second rotary bell-shaped member which faces away from said second rotary bell-shaped member, the arrangement being such that a first portion of said material from said supply system is distributed to said internal
  - 20 shaping region via an internal surface of said second rotary bell-shaped member and a second portion to said material from said supply system is distributed to said

internal internal shaping region via said at least one through-hole and said external face, and wherein said first and second rotary bell-shaped members rotate differently such that at least a major part of said particulate material is subject to differing rotary forces imparted by said first and second rotary bell-shaped members.

10. A device as claimed in claim 9, wherein said first and second rotary bell-shaped members rotate in opposite directions.

11. A device as claimed in claim 9, further comprising a deflector arranged to deflect said first portion of said material onto said internal surface of said second rotary bell-shaped member.

12. A device as claimed in claim 11, wherein said rotary disc and said deflector are connected with said second rotary bell-shaped member so as to be rotatable therewith.

13. A device as claimed in claim 9, wherein said disc is a frusto-conical disc disposed within said second rotary bell-shaped member and cooperable with said internal surface to define a passage for said first portion of said material.



14. A device as claimed in claim 9, further comprising respective air turbines for said rotary bell-shaped members, respective air bearings for said air turbines, and separate air supply conduits to said air bearings and said air turbines whereby said air bearings are supplied separately of said air turbines.

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15. In combination, a robot arm and a device as claimed in claim 1 mounted on said robot arm.

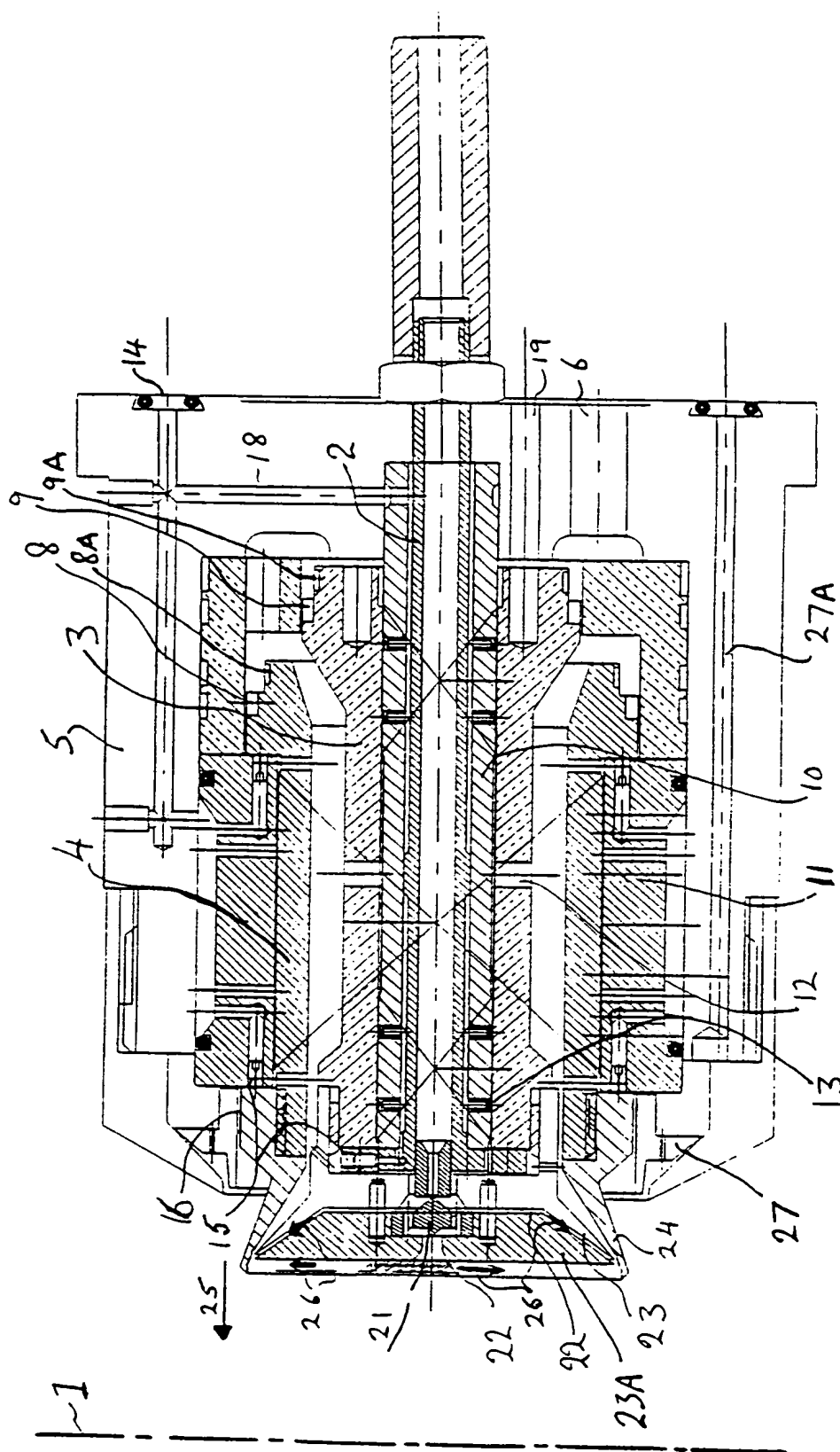
Abstract of the Disclosure

A device for transmitting a beam of material in particulate form for  
5 example for use as an atomised particle paint sprayer

comprises an outer bell-shaped member which is rotatable about a principal  
axis and arranged to project a conical curtain of small particles flowing generally  
towards a target,

a supply system for supplying material from a reservoir source to an  
10 internal shaping region of the outer bell-shaped member to create the conical  
curtain of small particles

there being an inner rotary bell-shaped member which is provided coaxially  
with the outer bell-shaped member and is arranged to rotate differently to the outer  
bell-shaped member so that at least a major part of the material emerging from the  
15 supply system is subject to differing rotary forces imparted by both the inner and  
outer rotary bell-shaped members.



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